DOE/GO-102001-1165
NREL/BK-710-29267
May 2001

3.8 Chemical Use in the Landscape

Chemical use is as old as agriculture itself and is generally taken for granted. We use chemicals to enhance plants' performance, to protect them from pests and disease, and to streamline maintenance. Originally, chemicals and compounds used to aid plant growth were biologically based or naturally occurring compounds. The majority of chemicals used today, however, are synthesized. Some of the synthetic chemicals introduced for weed and pest control following World War II were later found to cause health or environmental problems and have been eliminated. Others, while still on the market, are considered hazardous or dangerous, and their use should be limited. In selecting chemicals for use in the landscape, we should be concerned not only with performance but also with life-cycle impacts associated with production, use, and disposal.

Opportunities

The use of chemicals to protect or improve plants is best addressed at the time plants are selected—by choosing plants not highly dependent on frequent or excessive chemical use. Certain other decisions about chemical use in the landscape—for example, to control dust, melt ice, and provide decay resistance for wood—can similarly be addressed up-front through good site planning. Formulating overall chemical-use objectives and a chemical-use plan should be done at the outset of a project.

Chemical usage can be modified after facility construction and landscaping, of course, particularly as maintenance and replacement cycles allow new routines and materials to be introduced, and as adjustments to new regulations are made.

Technical Information

The key to responsible chemical use lies in minimizing the need for chemicals and, when needed, relying on organic, biodegradable, nontoxic, and natural products. Conventional chemical use can provide initial success but often leads to longer-term problems—for example, residues can stay in the soil for years, affecting both plant health and water quality. Increased pest resistance to chemical controls (and opening up the ecosystem to new, and potentially more harmful, pests) is a common outcome of highly chemical-dependent landscape management practices.

Use native or noninvasive naturalized plant species and cultivars that thrive under the specific microclimatic and soil and water conditions of various parts of the grounds, that won't need fertilizing, and that are naturally resistant to local pests and diseases.

Ecosystem diversity enhances landscape health. Plant many species, including species that naturally coexist as plant communities. This will provide habitat for stable populations of insects and other organisms—beneficial and harmful alike. Diversity ensures that if one pest momentarily gains the upper hand, it is unlikely to wipe out an entire planting. It also means that there are more likely to be natural predators of a particular pest species.

Use soil and drainage designs specific to the microclimate and to planting design objectives—provide a healthy, nontoxic growing medium.

Whenever possible and affordable, use natural, biologically derived, organic fertilizers instead of nonorganic, synthesized materials. Conventional (nonorganic) nitrogen fertilizers, for example, are very energy-intensive to produce. In creating an energy-efficient green building, consider how energy-intensive the landscape is! Composted manure and kitchen scraps provide a very good soil amendment, and the latter can help to reduce a facility's solid waste output.

Maintain observational and response records of problems, solutions, and changes made to the grounds. Good records can help provide insight into new techniques, changes, and improvements that might otherwise not be identified. Plant health is a long-term, not a short-term, management issue.

New products and families of products are arriving all the time—from genetically modified organisms and compounds produced by genetic manipulation of plant and animal stock to growth inhibitors and species-specific attractants or baits. Some of these offer tremendous opportunity for reduced chemical use; others raise new environmental and health questions. Be aware of the chemicals you are using and whether there might be hidden risks.

INTEGRATED PEST MANAGEMENT

IPM—using mechanical, physical, cultural, biological, and (as a last resort) least-toxic chemical means—is a fundamentally sound way of keeping pests in check. IPM has been used with success for decades, but this success requires careful planning, initial work, and the

acceptance that results are rarely immediate but will be achieved over time. The IPM approach uses known (often organic) compounds, fertilizers produced from natural materials, even beneficial insects, minerals, and salts, to achieve success. Extra up-front work to design and plan the system is a basic difference from the traditional "see the problem, open a bag, look for new problems afterward" approach. Plants and animals are healthy and necessary parts of an ecosystem—and health calls for balance, not war.

The basic tenet of this low-chemical approach is *organic*, or natural gardening and grounds maintenance—using materials derived from naturally occurring compounds and techniques of planting design and maintenance that give the best results with the least impact on the environment. This approach demonstrably creates a better environment for plants as time passes.

Safety should always be a concern, even with state-of-the-art IPM techniques, as some products—even natural ones—can be irritating or cause health problems upon application, even though they rapidly disperse and biodegrade after release.

An IPM management plan should be made for the long haul, planned for several years after implementation. Monitoring is an important part of implementing an IPM program. This can help establish (at least for an existing facility) a baseline from which to measure changes and successes. Monitoring activities typically include:

- Routine examination and journal entries recording the health of plants and any indications of disease and pests.
- Tracking of temperatures and climate indicators to predict pest insect developmental stages and emergence. Pheromone traps can be used to confirm the presence of pests and determine appropriate timing for controls.
- Identification of pest sources, nest locations, and feeding areas on site and in the surrounding neighborhood to assist in developing area-wide strategies, if possible, for control.

A full IPM plan should incorporate, or plan for, the use of:

- Habitat destruction or modification procedures for dealing with pest insects, at least during one stage of the life cycle. Control the development of pests and health problems by removing potential habitat, by choosing healthy plant material, and by providing good drainage, plenty of air movement, healthy soil, effective pruning, and careful clean-up practices.
- Installation of permanent or seasonal barriers: covers, traps, and other mechanical installations that physically inhibit infestation. This practice extends as well to buildings through design and construction practices that minimize the risk of insect entry and damage.
- Controlled release of naturally occurring parasites, predators, and pathogens that can control pests.
- Naturally derived pesticides such as insecticidal soaps, horticultural oils (petroleum-based products with low toxicity that biodegrade rapidly in the soil), diatomaceous earth, and botanical pesticides (plant-derived products that are by nature toxic to selected insect pests).
- Application of minerals—such as sulfur, copper, and lime—that are useful in fighting fungal and bacterial diseases.

References

Olkowski, William, Sheila Daar, and Helga Olkowski, *Common-Sense Pest Control*, Taunton Press, Newtown, CT, 1991.

Holmes, Roger, ed., *Taylor's Guide to Natural Gardening*, Houghton Mifflin Company, Boston, MA, 1993.

Pirone, P. P., J. R. Hartman, M. A. Sall, and T. P. Pirone, *Tree Maintenance*, Oxford University Press, 1988.

Thompson, William, and Kim Sorvig, *Sustainable Landscape Construction: A Guide to Green Building Outdoors*, Island Press, Washington, DC, 2000.

Contacts

American Society of Landscape Architects, 4401 Connecticut Avenue, NW, 5th Floor, Washington, DC 20008; (202) 686-2752; www.asla.org.

Local agricultural extension offices are good sources of information on soils and regionally appropriate landscaping practices.